shaded bank at White Lake. Mr. B. D. Gilbert and the writer found a single plant on the Whitestown bluffs, in October, 1902, the station recorded for Microstylis, and it is of interest to note that Mr. Gilbert (Fern Bull. xii. 99) records this Botrychium from Lewis County.

(*To be continued.*)

## CHLOROCHYTRIUM LEMNAE IN AMERICA.

Frank S. Collins.

Plants of the genus *Chlorochytrium* are of interest from their peculiar habitat and their special adaptations to the same. They are unicellular algae, and live in the tissues of higher, or at any rate larger organisms; not really as parasites, as they have well developed chromatophores and can assimilate their own nourishment; nor does it appear to be a case of symbiosis, as it is not easy to see what advantage their presence is to the host plants. Another point of interest is that *Chlorochytrium* is one of the relatively few genera represented both in salt and in fresh water; of the salt water forms three are known as American; *C. inclusum* Kjellm., in red algae at Greenland and from Alaska to Washington; the development of this species has been studied by Freeman[1]; *C. dermatocolax* Reinke, in *Chaetopteris* and *Sphacelaria* in Greenland; and *C. Schmitzii* Rosenv., in various loose tissued algae from Greenland to Maine. *C. Cohnii* Wright is found in *Enteromorpha* and some other algae, and in the gelatinous sheaths of such diatoms as *Schizonema*, along the New England coast; but this is now usually put in another genus, as *Chlorocystis Cohnii* (Wright) Reinhard. This species has been studied by Moore,[2] and the development well worked out.

Of the fresh water species the best known is *C. Lemnae* Cohn, which appears to be generally distributed in Europe, and whose development is quite well known. The host plant is *Lemna trisulca*

[1] E. M. Freeman, Observations on Chlorochytrium; Minn. Bot. Studies, Vol. II, p. 195. 1899.

[2] G. T. Moore, New or little known unicellular algae. I. Chlorocystis Cohnii; Bot. Gazette, Vol. XXX, p. 100, 1900.

L., which although apparently not common in America, certainly not in New England, is widely distributed, practically all over the United States. As most European fresh-water algae occur in America, there seemed to be reason to expect *C. Lemnae*, and by the kindness of Dr. B. L. Robinson, the writer was able to make an examination of the *Lemna trisulca* in the Gray herbarium. The result was satisfactory, as in the first specimen examined every frond contained many individuals of the *Chlorochytrium*, in various stages of development. The specimen was from Seabrook, New Hampshire, collected by Mr. A. A. Eaton, 18 July, 1896. That this species belongs in our flora is therefore certain, but that it is common is unlikely, for on examination of the other specimens, about twenty-five in all, from all parts of North America, not a single instance of the occurrence of the endophyte was found.

The cells of the *Chlorochytrium* show as relatively large, ovoid or ellipsoid, dark green bodies, between the cells of the host; they are to be detected only by microscopic examination, but are then seen easily with relatively low powers. When fully mature, the contents of the cell is transformed into numerous biciliate zoospores, of the usual ovoid form; the cells of the host plant have been pushed apart by the growth of the *Chlorochytrium* so that when the wall of the latter breaks, the zoospores pass out into the water, not free, but enclosed in a gelatinous vesicle; within this they conjugate, and the 4-ciliate zygote then escapes from the gelatine and swims freely for a while; then it comes to rest. Unless it settles upon a frond of *Lemna trisulca*, it perishes; but if attaching itself to this frond, it germinates, the pointed end, from which the cilia have fallen, pushing in between the cells of the host, till it reaches a comparatively open space, when it expands, and the protoplasm is drawn in, only a small button-like appendage remaining to show the point of entrance; the cell then grows to the full size, and zoospores are again formed.

There are several other endophytic algae found in Europe, whose development more or less resembles that of this species; a search for some of them was made in the Gray Herbarium, without results. An herbarium specimen is usually selected to show a plant in its best condition, while the endophytes usually do not reach their full development until the host has passed its prime; better success may be expected from an examination of living plants of the suspected hosts. The following European species have been well studied, and

can readily be identified. *Chlorochytrium Knyanum* Cohn & Szym., in *Lemna minor* L., *L. gibba* L., *Ceratophyllum demersum* L. and *Elodea Canadensis* Michx.; *Endosphaera biennis* Klebs in *Potamogeton lucens* L.; and *Phyllobium dimorphum* Klebs in *Lysimachia Nummularia* L., *Ajuga reptans* L., *Chlora serotina* Koch, and *Erythraea Centaurium* Pers. Undoubtedly many other species occur in other hosts, and there is quite a field here for a careful and persistent investigator.

Malden, Massachusetts.

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Dicksonia pilosiuscula forma schizophylla in Vermont. — Last August, while devoting myself most assiduously to the ferns of Dorset, Vermont, I brought in one day, two fronds of what I at first supposed to be a peculiar form of *Nephrodium spinulosum*. In the autumn I sent them with a number of others to Mr. Davenport, who pronounced them to be not *Nephrodium*, but a form of *Dicksonia*, found in Andover, Connecticut, in 1901, by Mr. A. Vincent Osmun of Amherst, and described by Mr. Clute in the Fern Bulletin for July, 1902, as *Dicksonia pilosiuscula*, forma *schizophylla*. I have compared the Dorset fronds with the type specimens at Amherst, and while these are larger, the peculiar texture and cutting are the same, and Mr. Osmun agrees in the determination. — Emily Hitchcock Terry, Northampton, Massachusetts.

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Three Plants new to the Flora of Vermont. — There has long been a tradition that the Canadian Waterleaf (*Hydrophyllum canadense*, L.) grew in Williamstown, Massachusetts; and naturally it has been sought for upon the slopes and in the ravines of Greylock Mountain, where its congener *H. virginianum* is common. In Rhodora vi. 155, 156, Mr. Deane cites the frequent reports of its occurrence in western Massachusetts, and notes nevertheless the want of any existing specimens from New England to substantiate these reports. Since then Mr. Hoffmann has reported (Rhodora, vi. 205) his discovery of the plant near Greylock in Massachusetts in the summer of 1904; and Mr. Deane's prediction that "botanists will certainly visit that locality again, and the species will surely come to light before long," has been verified.